BALLANTINE

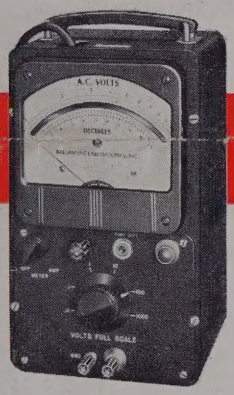
Ballantine Voltmeters are unique electronic instruments offering great sensitivity, wide frequency coverage and a high order of precision, and are designed for maximum compactness and convenience in operation. Alone or in combination with Ballantine accessories, they may be used to measure AC voltages from 20 microvolts to 28,000 volts, DC voltages from 10 microvolts to 100 volts and AC and DC currents from 0.1 microampere to 10 amperes.

Each Ballantine Voltmeter comprises a multi-stage amplifier, a signal rectifier and a specially designed moving coil indicating instrument whose deflection is proportional to the logarithm of the current through it. By using logarithmic scale meters the same accuracy is achieved *AT ANY POINT ON THE SCALE.*

The accuracy of the usual linear meter is proportionally smaller for down scale readings. Negative feedback is employed to stabilize the voltmeter by counteracting the effect of changes in line voltage, tubes and other circuit parameters.

Modifications can be obtained in any of the standard instruments shown below to meet particular preferences in special scales, mountings, finishes, terminal arrangements, etc. We also invite inquiries concerning special custom instruments other than these in meeting your own particular requirements.

Write today for complete catalog. Contains detailed information on all Ballantine Voltmeters, Amplifiers and Accessories.



AUDIO to 250kc MODEL 300D

The Model 300D is a new instrument which combines some of the original designs of the Model 300 Voltmeter with greatly improved stability, reliability and extended life. It features a large, easy to read logarithmic mirror-scale indicating meter; high input impedance; freedom of disturbing effects of line voltage fluctuations of either long time or transient variety; small size and light weight.

Other features such as operating the tubes well below their normal ratings will assure long term accuracy and freedom from frequent calibration checks.

Special design emphasis was given to provide a voltmeter of such reliability as is usually found only in laboratory standards.

SPECIFICATIONS

Voltage Range ..... 1 mv — 1000 v
Frequency Range ..... 10 cps — 250 kc (sine wave)
Accuracy ..... 2% ENTIRE RANGE
ANY POINT ON SCALE
Input Impedance ..... 2 meg shunted by 15 $\mu\mu$f
except 25 $\mu\mu$f on most sensitive range
Scales ..... Logarithmic voltage scale from 1 to 10;
auxiliary linear scale in decibels from 0 to 20

AUDIO to 150kc MODEL 300

The Model 300 is the forerunner and the most popular of all sensitive type AC voltmeters. This voltmeter has withstood the test of time, and in its present improved form offers reliability, ruggedness, precision, and low-cost. It has been adopted as the standard voltmeter for many standard tests.

This instrument employs a decade attenuator incorporating precision wire-wound resistors, a high-gain three stage negative feedback stabilized amplifier, a rectifier and a logarithmic meter responding to the average values of the voltage wave but calibrated in RMS values of a sine wave.

SPECIFICATIONS

Voltage Range ..... 1 mv to 100 volts
Frequency Range ..... 10 cps to 150 KC
Accuracy ..... 2% ENTIRE RANGE
ANY POINT ON SCALE
Input Impedance ..... 0.5 meg shunted by 30 $\mu\mu$f
Scales ..... Logarithmic voltage scale from 1 to 10;
auxiliary linear scale in decibels from 0 to 20

SUB-AUDIO to 150kc MODEL 302C

Battery Operated

The fact that the Model 302C Voltmeter is powered by its own batteries makes it particularly useful in cases where no external AC power source is available or where it is not desirable to use such a source because of limitations imposed by even a small amount of residual 60 cps line frequency hum. The Model 302C is also particularly useful where measurements are to be made in ungrounded or symmetrical circuits.

While possessing unsurpassed voltage sensitivity for a battery-operated instrument, since it measures down to 100 microvolts, the Model 302C permits measurements to be made from 2 cps through 150 kc with high input impedance.

SPECIFICATIONS

Voltage Range ..... 100 μv — 1000 v
Frequency Range ..... 2 cps — 150 kc
Accuracy ..... 3% 5 cps — 100 kc
ANY POINT ON SCALE
Input Impedance ..... 2 meg shunted by 10 $\mu\mu$f*
Noise Level ..... Less than 10 μv referred to
shorted input circuit
Scales ..... Logarithmic voltage scale from 1 to 10;
auxiliary linear scale in decibels from 0 to 20
* Shunt capacitance, 25 $\mu\mu$f on two most sensitive ranges

BALLANTINE ELECTRONIC VOLTMETERS

MODEL 305 PEAK-TO-PEAK

The Model 305 Voltmeter is designed to measure peak to peak values of repetitive waveforms. It responds to peak values of short periodic pulses having a repetition rate so low that it is impossible to measure their true peak values on ordinary electronic voltmeters. This voltmeter will measure peak-to-peak voltages from 1 millivolt to 1,000 volts (with an accuracy of better than 5%) for pulses from 3 to 250 microseconds having a repetition rate as low as 20 per second.

The Model 305 Voltmeter employs a resistance-capacity decade attenuator, a high gain negative feedback stabilized amplifier, a rectifier and a logarithmic indicating meter. Special circuits are used to respond to waveforms of very low energy content.

SPECIFICATIONS

Voltage Range ..... 1 mv — 1000 V peak-to-peak
Freqency Range ..... 10 cps — 100 kc (sine wave)
Pulse Width ..... 3 μsec — 250 μsec
Min Rep Rate ..... 20 pulses per sec
Accuracy ..... 5% for pulses and 3% for sine waves AT ANY POINT ON SCALE
Input Impedance ..... 2 meg shunted by 8 $\mu\mu$f*
Scales ..... Logarithmic voltage scale from 1 to 10; auxiliary linear scale in decibels from 0 to 20

* Shunt capacitance, 15 $\mu\mu$f on two most sensitive ranges

MODEL 310A AUDIO to 2 mc

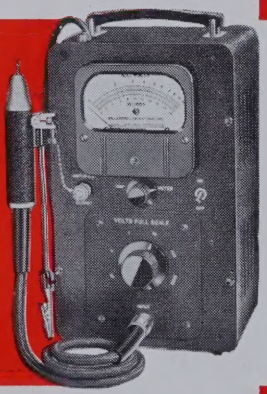
The Model 310A provides greater sensitivity, a wider frequency range, a higher input impedance, but somewhat less accuracy than the Model 300. It fills an extremely broad variety of needs, such as high level acoustic measurements, low level vibration measurements, microphone and phonograph studies, audio amplifier tests, carrier telephone transmission, ultrasonic development, and AM broadcast band signal measurements. A device is provided for removing the zero suppression existing in the logarithmic meter of the Model 310A, thus allowing it to be used as an effective bridge null detector for signals down to 10 microvolts.

SPECIFICATIONS

Voltage Range ..... 100 μv — 100 v Down to 40 μv at reduced accuracy
Frequency Range ..... 10 cps — 2 mc As null detector 5 cps — 4 mc
Accuracy ..... 3% 15 cps — 1 mc and 5% elsewhere AT ANY POINT ON SCALE
Input Impedance ..... 2 meg shunted by 9 $\mu\mu$f*
Scales ..... Logarithmic voltage scale from 1 to 10; auxiliary linear scale in decibels from 0 to 20

* Shunt capacitance, 19 $\mu\mu$f on two most sensitive ranges

MODEL 314 AUDIO to 6 mc

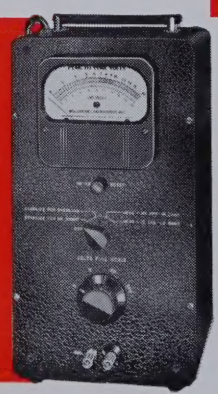


The Model 314 particularly fulfills the need for an accurate, compact, wide-range voltmeter of great sensitivity to facilitate the development and servicing of equipment in video applications, as well as in other fields such as r.f. heating, vibration, ultrasonics, piezo-electricity, etc. It is recommended for consideration as an attractive alternative to Models 300 and 310A whenever the latter are regarded as being limited with respect to frequency range, input impedance, and maximum voltage indication for the application being considered.

SPECIFICATIONS

Voltage Range ..... 1 mv — 1000 v (100 μv — 1 mv without probe)
Frequency Range ..... 15 cps — 6 mc
Accuracy ..... 3% 15 cps — 3 mc and 5% elsewhere AT ANY POINT ON SCALE
Input Impedance ..... 11 meg shunted by 8 $\mu\mu$f (1 meg shunted by 25 $\mu\mu$f without probe)
Scales ..... Logarithmic voltage scale from 1 to 10; auxiliary linear scale in decibels from 0 to 20

MODEL 316 INFRANSONIC 0.05 cps to 30 kc



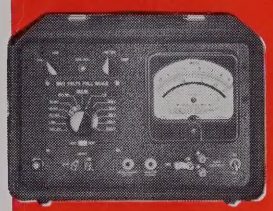
The Model 316 satisfies the need for reliable voltage measuring apparatus in such applications as the development, design and routine testing of automatic control systems involving low frequency servo-mechanisms, and in many other fields where sub-audio frequencies down to 0.01 cycle are encountered. An example of its utility is in monitoring the outputs of a number of commercially available, low-frequency signal generators which are not furnished with an output meter.

This model is almost completely free of meter pointer "flutter" down to 0.05 cycle, while down to 0.01 cycle the variation will be small compared to the sweep occurring when using a dc voltmeter to observe the peak amplitude of infrasonic waves.

SPECIFICATIONS

Voltage Range ..... 20 mv — 200 v peak-to-peak
Frequency Range ..... 0.05 cps — 30 kc (Down to .01 cps with correction)
Accuracy ..... 3% ENTIRE RANGE AT ANY POINT ON SCALE
Input Impedance ..... 10 meg shunted by 17 $\mu\mu$f or 40 $\mu\mu$f depending on setting
Scales ..... Logarithmic voltage scale from 2 to 20; auxiliary linear decibel scale from 0-20

MODEL 320 TRUE ROOT-MEAN-SQUARE INDICATION



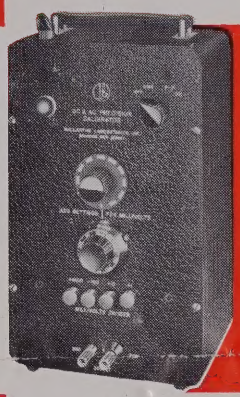
The Model 320 is a sensitive, general purpose, wide-range electronic instrument designed for voltage measurement in AC systems operating at power, audio and ultrasonic frequencies where it is essential to determine the true root-mean-square magnitudes of periodic complex waves or noise potentials. It accepts distorted waveforms with a crest factor from 5-15 depending on scale reading. It must not be confused with a wide variety of electronic voltmeters of either the average or peak responding types which although stated to read RMS voltage do so only when the waveform is sinusoidal.

Operation is not dependent on thermocouples or other thermally sensitive devices and thus this model is not subject to drawbacks as accidental burnout, sluggish response, insensitiveness, low input impedance and susceptibility to fluctuations of ambient temperature.

SPECIFICATIONS

Voltage Range ..... 100 μv — 320 v
Frequency Range ..... 5 cps — 500 KC
Accuracy ..... 3% 15 cps — 150 KC and 5% elsewhere AT ANY POINT ON SCALE
Stability of Internal Calibrator 0.5%
Input Impedance ..... 10 megs shunted by 18 $\mu\mu$f below 10 mv; 10 megs shunted by 8 $\mu\mu$f above 10 mv
Scales ..... Logarithmic voltage scale from 1 to 3.2 and from 3.1 to 10; auxiliary decibel scale from 0 to 10

MODEL 420 DC & AC PRECISION CALIBRATOR



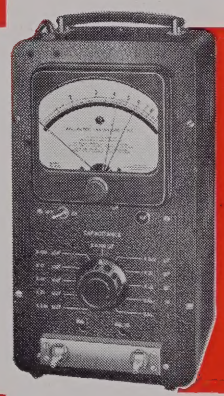
The Model 420 provides an accurate and a most convenient means for calibrating voltmeters, oscillographs, and other voltage sensitive devices, in the laboratory, and also in the shop and in the field where its ruggedness and simplicity of operation is found very advantageous. The Model 420 is an exceptional instrument having built-in stable signal sources of DC and distortion free AC together with a continuously variable precision attenuator system. It is ideal as a secondary standard.

Note the benefits: A. No preliminary setting up adjustment. B. Output voltage can be read directly from the dials.

SPECIFICATIONS

Voltage Range .... 0-10 v RMS; Peak-to-Peak, or DC
Frequency (Std. Model) ..... 1 KC
Voltage Accuracy (long term) ..... Better than 0.5%
Distortion and Hum ..... Less than 0.25%
Setting Resolution Approaches 0.01% above 10 mv
Output Impedance (AC) ..... 2-20 ohms depending on range setting
Output Impedance (DC) ..... 0-4000 ohms depending on dial setting

MODEL 520 DIRECT READING CAPACITANCE METER



This instrument represents one of the fastest and most convenient means available for measuring capacitance with good accuracy over an extremely wide range of values, such as those encountered in paper, plastic, mica, ceramic, and air-dielectric type capacitors. Furthermore, the principle of operation permits its use in the measurement of direct capacitance occurring in three-terminal systems. This property, together with the ability to register capacitance down to one one-hundredth of a micromicrofarad, renders the Model 520 of particular usefulness in segregating stray effects from the measurement of very low value capacitors having appreciable lead-to-ground capacitance. Capacitance is read directly on a large 5-inch mirrored scale meter which also features two adjustable indexes for "go-no-go" testing.

SPECIFICATIONS

Capacitance Range ..... 0.01 $\mu\mu$f to 12 μf
Accuracy ..... 2 % from 0.1 $\mu\mu$f to 12 μf and 5% from 0.01 to 0.1 $\mu\mu$f, when the capacitor dissipation factor does not exceed 0.05 AT ANY POINT ON SCALE
Test Frequency ..... 1 KC
Meter ..... Logarithmic mirror scale reading from 1 to 12

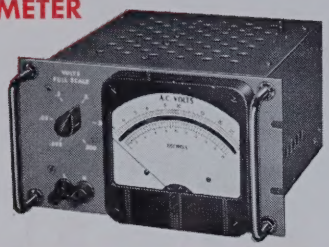
MODEL 700 SENSITIVE DC TO AC INVERTER

The Model 700 Sensitive Inverter has been designed to meet the need for a stable precise voltmeter accessory that will permit the measurement of DC potentials of microvolt levels by converting the DC into a precisely amplified AC signal to which an electronic voltmeter is responsive. An important feature of the Model 700 is a built-in calibrator which can be used to correct major errors caused by companion voltmeters or by serious departures of line voltage or frequency from nominal values. It possesses high power sensitivity, high input resistance, distortion free AC output, immunity to stray line-frequency fields, means for polarity sensing of the DC signal being measured and extremely small zero shift. The circuit comprises a DC chopper synchronized at line frequency, preceded by an input low-pass filter and followed by a selective amplifier which has a precise, stable gain and a passband of nearly uniform response in the range of 50 to 70 cycles.

SPECIFICATIONS

Input Voltage Range ..... 10 μv — 100 v
Threshold of Detection ..... 1 μv
Ratio of DC Input to AC RMS Output 1:100 and 10:1
DC Input Resistance ..... for 1:100 ratio — 10 Meg for 10:1 ratio — 50 Meg
Equivalent Input Noise Level and Zero Offset for 1:100 = 3 μv approx. and for 10:1 = 3 mv approx.
Calibration Accuracy 0.25%
Output Line Frequency 60 cycles, 10 volts RMS max.
Min. Load Impedance ..... 50,000 ohm

MODEL 300E
A "SYSTEMS" VOLTMETER

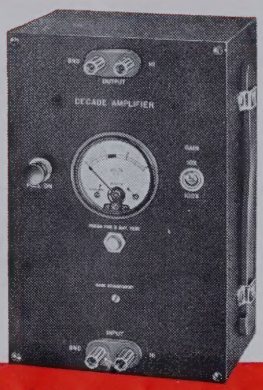


The Model 300E Voltmeter meets the demand for a "systems" voltmeter, i.e., a voltmeter for incorporation as a unit in a complete group of measuring or test equipments. It is available in either full (19") or half-width (9½") relay rack panels just 5¼" high. The signal input can be connected to front terminals or to a BNC (UG-290-U) jack at the rear. The panel is isolated from the chassis or signal ground, for ultimate connection to a separate systems ground. The range switch shaft extends out at the rear, permitting adaptation to automatic programming. The instrument is compact, very rugged and possesses outstanding stability. It has a large size easy to read indicating meter which is accurate within 2% at any point on the scale. It is also available in a "MIL" version.

SPECIFICATIONS

Voltage Range ..... 300 μv — 300 volts
Frequency Range ..... 30 cps — 100 KC
Accuracy ..... 2% ENTIRE RANGE AT ANY POINT ON SCALE
Input Impedance ..... 2 meg. shunted by 20 μμf except 30 μμf on 2 most sensitive ranges
Meter Scale ..... Logarithmic voltage scale from 3 to 30; auxiliary linear decibel scale from 0 to 20

MODEL 220B
DECADE AMPLIFIER



The Model 220B Decade Amplifier provides stabilized voltage amplifications of precisely 10 or 100, either of which may be selected by a panel-mounted switch. It is powered by self-contained readily available commercial batteries having a life of at least 150 hours with normal use. A meter is provided on the panel for testing the condition of the batteries.

An important application of this instrument and the Model 300 Voltmeter is in low level noise measurements, such as in the test methods of specification JAN-R-11. The amplifier may be used within the limits of its frequency response of 10 to 150,000 cps with other Ballantine Voltmeters or for other applications when stable voltage gains of 10 or 100 are desired.

SPECIFICATIONS

Voltage Range ..... 20 μv — 50 mv
Frequency Range ..... 10 cps — 150 kc
Accuracy of gain ..... 2% ENTIRE RANGE
Input Impedance ..... 5 meg shunted by 15 μμf
Output Impedance ..... Less than 900 ohms in series with 2 μf for 10x gain; less than 7,000 ohms in series with 2 μf for 100x gain
Noise referred to Input ..... 25 μv open circuit, 8 μv short circuit

SERIES 1300
VOLTAGE MULTIPLIERS

The upper voltage range of most Ballantine Voltmeters can be extended by the use of accessory multipliers. The multiplier ratings are shown in the table:

Related Voltmeter Model	Multiplier Model No.	Max. Voltage Measurable	Multiplier Factor	Input Impedance Rsh/ MΩ	Input Impedance Csh/ μμF
300	1300A	1KV RMS	X10	5	8
300	1300B	10KV RMS	X100	40	3
305	1305B	10KV RMS 28KV P-to-P	X100	40	3
301A	1310A	1KV RMS	X10	20	8
302C & 310A	1310B	10KV RMS	X100	40	3
314	1314	10KV RMS	X100	40	3
316	1316	7.07KV RMS 20KV P-to-P	X100	40	3
320	1320	10KV RMS	X100	40	3

SERIES 600
PRECISION SHUNT RESISTORS

Ballantine Voltmeters can be readily converted into sensitive and accurate direct-reading AC microammeters and ammeters by merely plugging into their input terminals the appropriate Precision Shunt Resistor illustrated here.

Precision Shunt Resistors Model	Resistance Ohms	Measurable Current Range: Maximum Current	Minimum Current When Used With Voltmeter Models: 300 and 305	302C, 310A, 314, 320	316
601	1	1 amp	1 ma	100 μa	20 ma
602	10	300 ma	100 μa	10 μa	2 ma
603	100	100 ma	10 μa	1 μa	200 μa
604	1000	30 ma	1 μa	0.1 μa	20 μa
605	0.1	3 amp	10 ma	1 ma	200 ma
606	0.01	10 amp	100 ma	10 ma	2 amp

BALLANTINE LABORATORIES

Boonton, New Jersey